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(REV 10-94)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

DOCKET #: 3397-112PUS

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING  
UNDER 35 U.S.C. 371**

U.S. APPLICATION NO.

10/069882

INTERNATIONAL APPLICATION NO

PCT/FI00/00746

INTERNATIONAL FILING DATE

September 01, 2000

PRIORITY DATE CLAIMED

September 01, 1999

TITLE OF INVENTION

Curtain Coater and Method for Curtain Coating

APPLICANT(S) FOR DO/EO/US


Timo KIIHA; Jukka KOSKINEN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau). (See Reply to Written Opinion)
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. Below concern other document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
  - ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information (*specify*): PCT Publication Sheet, Int'l Preliminary Examination Report, Reply to Written Opinion, PCT Request, PCT Demand, and Notification of the Recording of a Change.

U.S. APPLICATION NO (If known see 37 CFR 1.53) <b>10/069662</b>		INTERNATIONAL APPLICATION NO <b>PCT/FI00/00746</b>		ATTORNEY'S DOCKET NUMBER <b>3397-112PUS</b>	
17. <input checked="" type="checkbox"/> The following fees are submitted:					
<b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO ..... <b>\$890.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482)..... <b>\$710.00</b> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))..... <b>\$740.00</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$1040.00</b> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... <b>\$100.00</b>					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$	890
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	38 - 20 =	18	x <b>\$18.00</b>	\$	324
Independent Claims	2 - 3 =		x <b>\$84.00</b>	\$	
Multiple dependent claim(s) (if applicable)			+ <b>\$280.00</b>	\$	
TOTAL OF ABOVE CALCULATIONS =				\$	1214
Reduction of 1/2 for filing by small entity, if applicable.				\$	
SUBTOTAL =				\$	1214
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$	1214
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property				\$	40
TOTAL FEES ENCLOSED					\$1254
				Amount to be refunded:	\$
				charged:	\$
a. <input checked="" type="checkbox"/> Two checks in the amounts of \$ <u>1214</u> and \$ <u>40</u> to cover the above fees are enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. <u>03-2412</u> in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>03-2412</u> . A duplicate copy of this sheet is enclosed.					
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>					
SEND ALL CORRESPONDENCE TO: <u>Michael C. Stuart</u> Cohen, Pontani, Lieberman & Pavane 551 Fifth Avenue, Suite 1210 New York, New York 10176			 <u>Michael C. Stuart</u> Registration Number: <u>35,698</u> February 27, 2002 Tel: (212) 687-2770		

By Express Mail # EV072606280US · February 27, 2002

Attorney Docket # 3397-112PUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of

Timo KIIHA et al.

International Appln. No.: PCT/FI00/00746

International Filing Date: September 01, 2000

For: Curtain Coater and Method for Curtain Coating

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231  
**BOX PCT**

S I R:

Prior to examination of the above-identified application, amend the application as follows:

IN THE SPECIFICATION (As amended by the Response to the Written Opinion):

Page 1 (Amended Sheet), before line 3, the paragraph beginning with "The present invention", insert the following title:

--FIELD OF THE INVENTION--.

Page 1 (Amended Sheet), delete lines 4 to 6 and insert therefor, the following new paragraph:

--The present invention relates to a curtain coater and to a curtain-coating method.--

Page 1 (Amended Sheet), before line 8, the paragraph beginning with "In a curtain coater," , insert the following title:

**--BACKGROUND OF THE INVENTION--**

Page 2, before line 20, the paragraph beginning with "It is an object", insert the following title:

**--SUMMARY OF THE INVENTION--**

Page 3 (Amended Sheet), delete lines 17 to 23.

Page 4, before line 5, the paragraph beginning with "In the following," insert the following paragraph and title:

-- Other objects and features of the present invention will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are intended solely for purposes of illustration and not as a definition of the limits of the invention, for which reference should be made to the appended claims.

**BRIEF DESCRIPTION OF THE DRAWINGS--**

Page 4, before line 16, the paragraph beginning with "Referring to FIG. 1," insert the following title:

**--DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS--**

Page 7, after the last line, insert the following paragraph:

--Thus, while there have been shown and described and pointed out fundamental novel features of the present invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices described and illustrated, and in their operation, and of the methods described may be made by those skilled in the art without departing from the spirit of the present invention. For example, it is expressly

intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated. It is also to be understood that the drawings are not necessarily drawn to scale but that they are merely conceptual in nature. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.--.

Page 8 (Amended Sheet), line 1, delete "Claims:" and insert therefor --What is claimed is:--.

IN THE CLAIMS:

Cancel claims 1 to 12, without prejudice.

Add the following new claims:

13. A curtain coater for coating a moving web of paper or board, the curtain coater comprising:

an applicator nozzle positioned above the web to be coated and configured so as to apply coating mix ejected therefrom to a surface of the web in a continuous curtain extending uniformly over a cross-machine width of the web; and

a doctoring means configured to remove a boundary air layer traveling on the surface of the web to be coated and being located upstream in the travel direction of the web of an impingement point of the coating mix curtain on the surface of the web and being located on the same side of the web as the applicator nozzle, the surface of the doctoring means facing the web being curved to support the web.

14. The curtain coater of claim 13, further comprising a gas-injection nozzle located downstream in the travel direction of the web of the applicator nozzle, configured so as to extend over the cross-machine width of the web, and adapted to blow gas toward the coating mix curtain applied to the web from the applicator nozzle.

15. The curtain coater of claim 13, further comprising a suction nozzle extending over the cross-machine width of the web and adapted to said doctoring means so as to remove by suction the boundary air layer traveling on the surface of the web.

16. The curtain coater of claim 14, further comprising a suction nozzle extending over the cross-machine width of the web and adapted to said doctoring means so as to remove by suction the boundary air layer traveling on the surface of the web.

17. The curtain coater of claim 15, wherein an inlet opening of the suction nozzle is on a downstream-directed wall of the doctoring means.

18. The curtain coater of claim 15, wherein an inlet opening of the suction nozzle is on a downstream-directed wall of the doctoring means.

19. The curtain coater of claim 15, wherein an inlet opening of the suction nozzle is on a surface of the doctoring means facing the web.

20. The curtain coater of claim 16, wherein an inlet opening of the suction nozzle is on a surface of the doctoring means facing the web.

21. The curtain coater of claim 13, wherein a distance between the web and the curved surface of the doctoring means is up to 500  $\mu$ m.

22. The curtain coater of claim 14, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

23. The curtain coater of claim 15, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

24. The curtain coater of claim 16, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

25. The curtain coater of claim 17, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

26. The curtain coater of claim 18, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

27. The curtain coater of claim 19, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

28. The curtain coater of claim 20, wherein a distance between the web and the curved surface of the doctoring means is up to  $500\text{ }\mu\text{m}$ .

29. The curtain coater of claim 13, wherein said doctoring means is a doctor bar.

30. The curtain coater of claim 14, wherein said doctoring means is a doctor bar.

31. The curtain coater of claim 15, wherein said doctoring means is a doctor bar.

32. The curtain coater of claim 16, wherein said doctoring means is a doctor bar.

33. The curtain coater of claim 21, wherein said doctoring means is a doctor bar.

34. The curtain coater of claim 22, wherein said doctoring means is a doctor bar.

35. The curtain coater of claim 23, wherein said doctoring means is a doctor bar.

36. The curtain coater of claim 24, wherein said doctoring means is a doctor bar.

37. The curtain coater of claim 13, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

38. The curtain coater of claim 14, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

39. The curtain coater of claim 15, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

40. The curtain coater of claim 16, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

41. The curtain coater of claim 17, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

42. The curtain coater of claim 18, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

43. The curtain coater of claim 19, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

44. The curtain coater of claim 20, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

45. The curtain coater of claim 21, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

46. The curtain coater of claim 29, wherein that a distance along the surface of the web from a downstream end of said doctoring means to the impingement point under said applicator nozzle is less than 50 mm.

47. A curtain-coating method for coating a moving web of paper or board, comprising:  
passing the web to be coated to a coater station; and

using an applicator nozzle positioned above the web to apply coating mix ejected therefrom to a surface of the web as a continuous curtain extending uniformly over a cross-machine width of the web;

removing a boundary air layer traveling along with the web from the surface of the web facing the applicator nozzle with a doctoring means located upstream in the travel direction of the web of the applicator nozzle; and

supporting the web with a curved surface of the doctoring means.

48. The curtain-coating method of claim 47, further comprising blowing gas toward the coating mix curtain being applied from the applicator nozzle from a gas-injection nozzle located downstream of the applicator nozzle in the travel direction of the web, the gas-injection nozzle extending over the cross-machine width of the web.

49. The curtain-coating method of claim 47, wherein the boundary air layer traveling on the surface of the web is removed by suction from a suction nozzle adapted to said doctoring means.

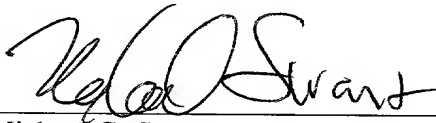
50. The curtain-coating method of claim 48, wherein the boundary air layer traveling on the surface of the web is removed by suction from a suction nozzle adapted to said doctoring means.

**REMARKS**

This preliminary amendment is presented to place the application in proper form for examination and to eliminate multiple dependency from the present claims. No new matter has been added. Early examination and favorable consideration of the above-identified application is earnestly solicited.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,  
COHEN, PONTANI, LIEBERMAN & PAVANE

By:   
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27 February 2002

Curtain coater and method for curtain coating

5 The present invention relates to curtain coater according to the preamble of claim 1 and to curtain-coating method according to the preamble of claim 10.

10 In a curtain coater, the coating mix is applied to the surface of a moving web of paper or board, generally from a nozzle extending over the full cross-machine width of the web and located above the web being coated, whereby the coating mix can fall onto the web surface as curtain-like shower. Curtain coating is categorized as a noncontacting coating method, wherein the applicator  
15 itself makes no contact with the web being coated, but instead, the coating mix is applied to the web surface in the form of a free-falling curtain of coating mix. The technique of curtain coating is described, e.g., in publication DE 196 22 080.

20 During its travel, a moving web gathers a thin boundary layer of air that moves along with the web. In curtain coaters, the momentum of the coating mix applied to the web surface is small as compared to the momentum of the coating mix amount directed from a jet applicator, for  
25 instance, which means that the boundary air layer traveling on the web surface can easily scatter the curtain of coating mix flowing from the nozzle of a curtain coater thus making the applied coating layer uneven. With higher  
30 web speeds in the coater station, the problem is accentuated due to the faster speed of the boundary air layer and its higher momentum. Hence, the control of the

boundary air layer behavior at higher web speeds becomes one of the most significant factors affecting the runnability of a curtain coater.

5 The problem associated with the boundary air layer can be diminished by way of, e.g., making the height of the falling curtain of coating mix larger thereby increasing its falling velocity or by increasing the amount of coating being applied, whereby the momentum of the coating  
10 mix curtain is increased and the falling curtain can more readily penetrate through the boundary air layer traveling on the web surface. However, it is generally not possible to make the falling height of the coating mix curtain sufficiently large because the coating mix  
15 curtain begins to converge and separate into streamlets with a larger falling height. Moreover, the increase of the amount of the applied coating mix necessitates doctoring away the excess coating from the web surface.

20 It is an object of the present invention to provide an entirely novel type of curtain coater and curtain-coating method offering an essential improvement in the reduction of the amount of boundary air penetration to the application zone of a curtain coater.

25 The goal of the invention is attained by way of placing a doctoring means upstream in front of the application point in the travel direction of the web being coated, the device serving to remove the boundary air layer from  
30 the surface of the traveling web. The purpose of the doctoring means is to bring about a significant reduction in the amount of the entrained air traveling along with

the web to the application zone. In one embodiment of the invention, the amount of the boundary air coming to the application zone is reduced by means of a suction nozzle cooperating with the air-doctoring element, whereby the boundary air layer is removed via the suction nozzle by a vacuum. Additionally, the adherence of the coating mix curtain to the web surface can be augmented by means of a gas-injection nozzle mounted downstream after the applicator nozzle in the travel direction of the web, whereby a gas jet can be directed from the gas-injection nozzle toward the coating mix curtain. Hereby, the combined momentum of the coating mix curtain and the gas jet becomes sufficiently energetic to force the coating mix to penetrate through the boundary air layer traveling on the web surface.

More specifically, the curtain coaters according to the invention are characterized by what is stated in the characterizing part of claims 1.

Furthermore, the curtain-coating method according to the invention is characterized by what is stated in the characterizing part of claims 10.

The invention offers significant benefits.

In a curtain coater according to the invention, the amount of boundary air traveling on the web being coated to the application zone can be reduced significantly as compared with conventional curtain coaters, whereby the coat quality and web runnability in the coater are improved. The web speed in a curtain coater according to

the invention can be readily increased because the boundary air layer can be removed effectively from the surface of the running web prior to application.

5 In the following, the invention will be examined in greater detail by making reference to the appended drawings in which

FIG. 1 shows schematically a cross-sectional side view of  
10 a conventional curtain coater; and

FIGS. 2-7 show schematically cross-sectional side views of different embodiments of curtain coaters according to the invention.

15 Referring to FIG. 1, the conventional curtain coater shown therein comprises an applicator nozzle 1 placed above a web 2 and extending in the cross-machine direction above the web 2 so as to permit application of the  
20 coating mix therefrom to the surface of the moving web 2. The travel direction of the web 2 is designated by an arrow. The boundary air layer traveling on the surface of the moving web 2 tends to deflect the curtain of coating mix being applied from the nozzle 1 in the travel direc-  
25 tion of the moving web 2. At a sufficiently high travel speed of the web, the steady flow of the coating mix curtain is disturbed and a portion of the applied coating mix is blown along with the boundary air in the travel direction of the web 1, whereby certain areas on the  
30 surface of the web 2 may remain entirely uncoated.

In FIG. 2 is shown an embodiment of a curtain coater,

wherein there is located upstream in front of the application zoned formed its applicator nozzle 1, upstream in the travel direction of the web 2, a doctoring means 3 having a curved contour and extending over the cross-machine width of the web 2 so as to scatter the boundary air layer traveling on the surface of moving web 2 before the air layer can reach the application zone and cause there problems in the coat quality. The doctoring means 3 is disposed so that its curved contour is above the surface of the web 2. Generally, between the moving web 2 and the doctoring means 3 is formed a boundary air layer, the thickness of which is determined, among other factors, by the speed of the web 2 and the radius of curvature on the curved contour of the doctoring means. Typically, the thickness of the air layer remaining between the web 2 and the curved contour of the doctoring means 3 is in the range of 0-500  $\mu\text{m}$ . The end point of the curved contour of the doctoring means 3 facing the web 2 is advantageously placed as close as possible to the starting point of the application zone under the nozzle 1, since a new layer of boundary air will be rapidly regenerated over a free length of the web downstream from the doctoring means 3. In practice, the boundary air layer can reach its original thickness within 50 mm of web travel.

In contrast to the arrangement of FIG. 2, the embodiment shown in FIG. 3 has the doctoring means 3 complemented with a suction channel 4 extending over the cross-machine width of the web 2 and having its inlet opening 7 located at the rear part of the doctoring means 3. In this fashion, the boundary air layer traveling on the surface

of the moving web 2 can be sucked into the suction channel 4.

In FIG. 4 is shown an arrangement wherein the inlet opening 7 of the suction channel 4 is adapted on the curved surface of the doctoring means 3 facing the web 2.

In FIG. 5 is shown an arrangement wherein there is placed upstream in front of the application zone of the applicator nozzle 1 a doctor bar 3 so that the bar makes a contact with the moving web 2 thus preventing the boundary air layer traveling on the moving web from reaching the application zone.

In FIG. 6 is shown an embodiment wherein there is placed downstream after the applicator nozzle 1 in the travel direction of the moving web 2 a gas-injection nozzle 5 extending over the cross-machine width of the web and adapted to direct a gas jet toward the coating mix curtain falling from the applicator nozzle. In the context of the present invention, the term gas is used when reference is made to any substance occurring in a gas phase including air, other gases and steam. When the combined momentum of the gas jet directed from the gas-injection nozzle 5 and the falling curtain of coating mix is sufficiently large as compared with the momentum of the boundary air layer traveling on the surface of the moving web 2, the coating mix curtain can unobstructedly adhere to the surface of the web 2. The streams flowing out from the applicator nozzle 1 and the gas-injection nozzle 5 are aligned to meet with each other before the coating mix curtain impinges on the web 2. By altering

the operating pressure of the gas-injection nozzle 5, the adherence of the coating mix layer to the surface of the web 2 can be controlled.

5 In FIG. 7 is shown an embodiment different from that of FIG. 6 by having a doctoring means 3 added upstream in front of the applicator nozzle 1 in the travel direction of the web 2 so as to remove the boundary air layer from the surface of the moving web 2. Herein, the doctoring  
10 means 3 serves to remove a portion of the boundary air layer, while the gas-injection nozzle 5 assures unobstructed adherence of the coating mix curtain to the surface of the web 2.

15 In addition to those described above, the invention may have alternative embodiments.

A rotary or stationary small roll can be used as the doctoring means 3. Also different modifications of the  
20 above-described exemplifying embodiments may be contemplated. For instance, the doctoring means 3 used in the embodiment of FIG. 7 can be complemented when necessary with the suction nozzles 4 used in the embodiments of FIGS. 3 and 4 thus improving the efficiency of boundary  
25 air removal from the surface of the web 2.

## Claims:

1. Curtain coater for coating a moving web (2) of paper or board, the curtain coater comprising an applicator nozzle (1) located above the web (2) to be coated so as to apply the coating mix therefrom to the surface of the web (2) in the form of a continuous curtain extending uniformly over the cross-machine width of the web (2), and doctoring means (3) serving to remove the boundary air layer traveling on the surface of the web (2) by being located upstream in the travel direction of the web (2) in front of the impingement point of the coating mix curtain on the surface of the web (2) and further being located on the same side of the web (2) as the applicator nozzle (1) characterized in that the surface of the doctoring means (3) facing the web is outward curved in order to support the web (2) at the doctoring point.
2. Curtain coater according to claim 1, characterized by a gas-injection nozzle (5) located downstream in the travel direction of the web (2) after the applicator nozzle (1) so as to extend over the cross-machine width of the web (2) and adapted to blow gas via said gas-injection nozzle toward the coating mix curtain being applied from the applicator nozzle (1).
3. Curtain coater according to claim 1 or 2, characterized by a suction nozzle (4) extending over the cross-machine width of the web (2) and adapted to said doctoring means (3) so as to remove by suction the boundary air layer traveling on the surface of the web

(2).

4. Curtain coater according to claim 3, c h a r a c -  
t e r i z e d in that the inlet opening (7) of the  
5 suction nozzle (4) is adapted to rear wall of the  
doctoring means (3).

5. Curtain coater according to claim 3 or 4, c h a r -  
a c t e r i z e d in that the inlet opening (7) of the  
10 suction nozzle (4) is adapted to the surface of the  
doctoring means (3) facing the web (2).

6. Curtain coater according to any one of foregoing  
claims, c h a r a c t e r i z e d in that the surface  
15 of the doctoring means (3) facing the web (2) has a  
curved shape.

7. Curtain coater according to claim 6, c h a r a c -  
t e r i z e d in that the distance of the web (2) from  
20 the curved surface of the doctoring means (3) is in the  
range of 0-500  $\mu$ m.

8. Curtain coater according to any one of foregoing  
claims, c h a r a c t e r i z e d in that said  
25 doctoring means (3) is a doctor bar.

9. Curtain coater according to any one of foregoing  
claims, c h a r a c t e r i z e d in that the distance  
along the surface of the web (2) from the doctoring point  
30 of said doctoring means (3) to the application point  
under said applicator nozzle (1) is less than 50 mm.

10. Curtain-coating method for coating a moving web (2)  
of paper or board, in which method

- 5           - the web (2) to be coated is passed to a coater  
            station,
- 10          - using an applicator nozzle (1) located above the  
            web (2), the coating mix is therefrom applied to  
            the surface of the web (2) in the form of a con-  
            tinuous curtain extending uniformly over the  
            cross-machine width of the web (2), and
- 15          - the boundary air layer traveling along with the  
            web is removed from the surface of the web (2)  
            facing said applicator nozzle (1) with the help  
            of a doctoring means (3) located upstream in the  
            travel direction of the web (2) in front of the  
            applicator nozzle (1),

20   c h a r a c t e r i z e d   i n   t h a t   o u t w a r d   c u r v e d  
doctoring means (3) is used in order to support the web  
(2) at the doctoring point.

11. Curtain-coating method according to claim 10,  
25   c h a r a c t e r i z e d   i n   t h a t   g a s   i s   b l o w n   t o w a r d  
the coating mix curtain being applied from the applicator  
nozzle (1) from a gas-injection nozzle (5) that is locat-  
ed downstream in the travel direction of the web (2)  
after the applicator nozzle (1) and is adapted to extend  
30   o v e r   t h e   c r o s s - m a c h i n e   w i d t h   o f   t h e   w e b   ( 2 ) .

12. Curtain-coating method according to claim 10 or 11,

c h a r a c t e r i z e d in that the boundary air layer traveling on the surface of the web (2) is removed by suction applied by a suction nozzle (4) adapted to said doctoring means (3).

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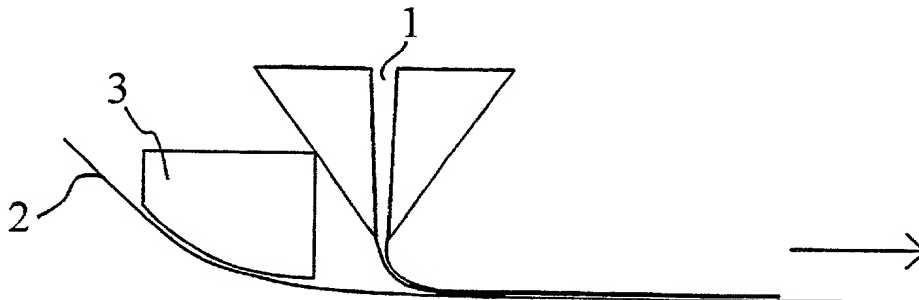
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CURTAIN COATER AND METHOD FOR CURTAIN COATING



(57) Abstract: The present invention relates to a curtain coater and a curtain-coating method for coating a moving web (2) of paper or board. The curtain coater comprises an applicator nozzle (1) located above the web (2) to be coated so as to apply the coating mix therefrom to the surface of the web (2) in the form of a continuous curtain extending uniformly over the cross-machine width of the web (2). The boundary air layer traveling on the surface of the web (2) is removed by a doctoring means (3) which is located upstream in the travel direction of the web (2) in front of the impingement point of the coating mix curtain on the surface of the web (2) and is further located on the same side of the web (2) as the applicator nozzle (1).

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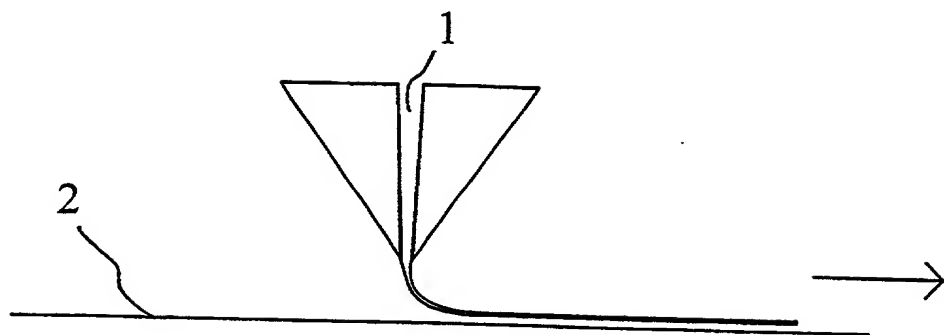


Fig. 1

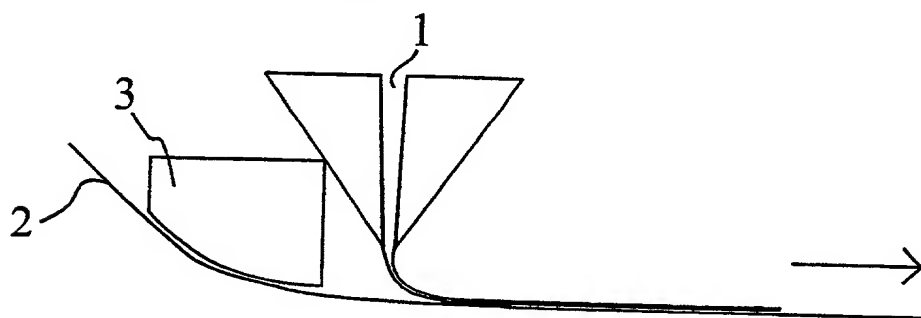


Fig. 2

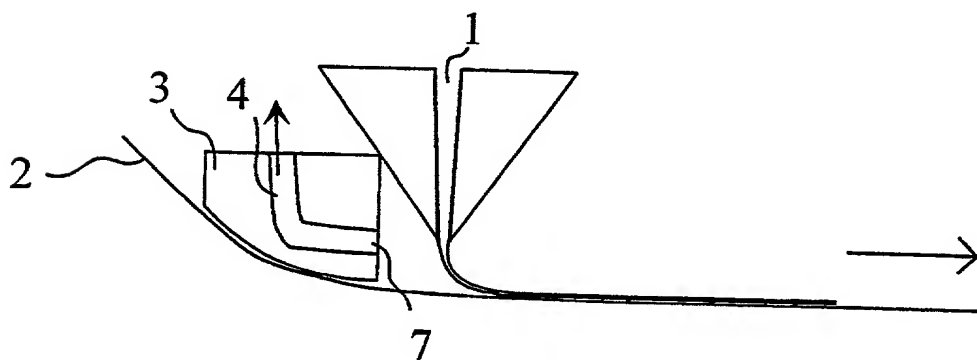


Fig. 3

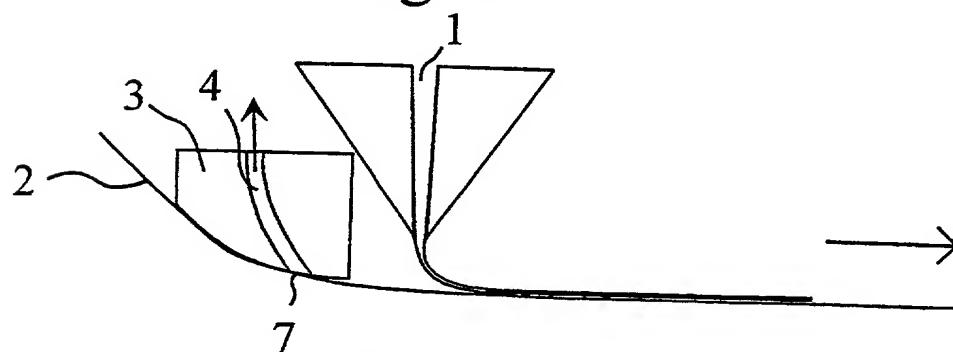


Fig. 4

2/2

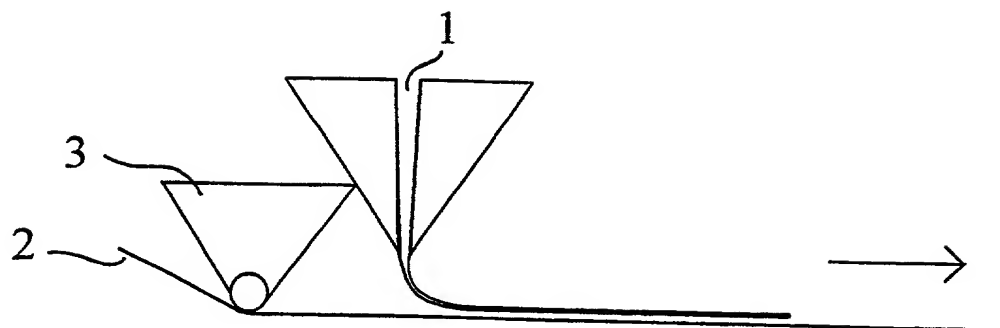


Fig. 5

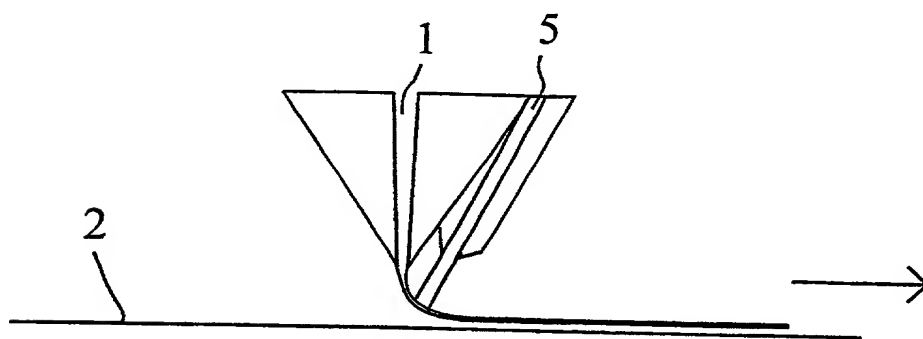


Fig. 6

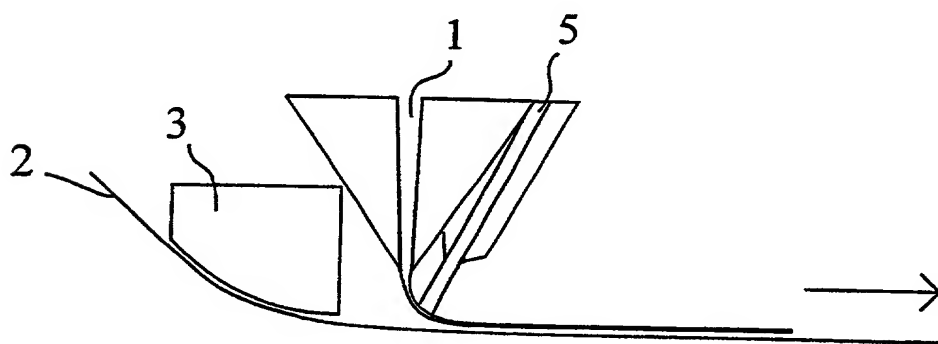


Fig. 7

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
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Attorney's Docket No.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Curtain coater and method for curtain coating

the specification of which (check only one item below)

☐ is attached hereto☐ was filed as United States application

Serial No. \_\_\_\_\_

on \_\_\_\_\_

and was amended

on \_\_\_\_\_ (if applicable).

☒ was filed as PCT international applicationNumber PCT/FI00/00746on September 1, 2000

and was amended under PCT Article 19

on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

**PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119	
Finland	19991863	1 September 1999	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
PCT	PCT/FI00/00746	1 September 2000	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**

(Continued)

Attorney's Docket No.

Includes Reference to PCT International Applications

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

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PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)		
PCT/FI00/00746	1 September 2000		x	

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (*List name and registration number*)

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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
2 1 1	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
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2 1 2	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
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<p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.</p>				
SIGNATURE OF INVENTOR 201		SIGNATURE OF INVENTOR 202		SIGNATURE OF INVENTOR 203
DATE February 20, 2002		DATE February 25, 2002		DATE
SIGNATURE OF INVENTOR 204		SIGNATURE OF INVENTOR 205		SIGNATURE OF INVENTOR 206
DATE		DATE		DATE
SIGNATURE OF INVENTOR 207		SIGNATURE OF INVENTOR 208		SIGNATURE OF INVENTOR 209
DATE		DATE		DATE
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